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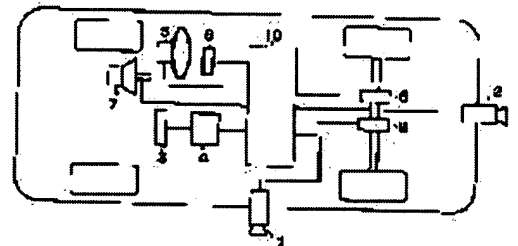
(21)Application number : 10-014175 (71)Applicant : NISSAN MOTOR CO LTD  
(22)Date of filing : 27.01.1998 (72)Inventor : KOREISHI JUN

(54) PARKING GUIDING DEVICE AND AUTOMATIC PARKING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To confirm a post-parking position before parking guidance of automatic parking is started by superimposingly displaying the image of a vehicle after guidance at the planned parking position on an ambient environmental image with a display means.

SOLUTION: A display 3 processes the ambient environment photographed by cameras 1, 2 with a graphic controller 4 and displays an ambient environmental image. The image of a completely guided vehicle is superimposingly displayed at the planned parking position of the vehicle on the ambient environmental image. An occupant is just required to move the vehicle until the projected image of the planned parking position reaches the position to be parked in a parking frame, or the occupant operates a position adjusting knob 6 to move the projected image of the planned parking position while seeing the display image without moving the vehicle. The situation of the vehicle after parking can be confirmed before parking guidance is started.



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the automatic parking equipment to which a car is automatically moved to the parking guide which guides a car to a parking location, and a parking location.

[0002]

[Description of the Prior Art] The location and parking location of a car are pinpointed by the sensor, and the parking guide which directs operation to crew and guides a car to a parking location is known (for example, refer to JP,9-35184,A).

[0003] However, in the conventional parking guide mentioned above, since the parking location is pinpointed by the sensor, it is parking within the limits and there is [ to right-justify ] a problem that a car cannot be parked at the location of the arbitration of parking within the limits to carry out a left-justify.

[0004] It is to enable modification of a parking location in the location of arbitration while enabling the check of the location after parking a car before parking induction initiation or automatic parking initiation of the purpose of this invention.

[0005]

[Means for Solving the Problem] (1) An image pick-up means by which invention of claim 1 picturizes the perimeter environment of a car, A display means to display a perimeter environmental image, and a parking predetermined position and a parking routing means to set up the path to there, It is applied to the parking guide equipped with a movement magnitude detection means to detect the movement magnitude of a car, and the guiding means which guides a car to a parking predetermined position in accordance with a path based on a movement magnitude detection value, and a display means indicates the image of the car after induction termination by superposition in the parking predetermined position on a perimeter environmental image.

(2) Invention of claim 2 is equipped with a repositioning means to change a parking predetermined position, and moves the image of the car after induction termination with a display means according to modification of the parking predetermined position by the repositioning means.

(3) Invention of claim 3 resets the path to the parking predetermined position after modification by the repositioning means with a parking routing means.

(4) When a car is moved by crew before invention of claim 4 started parking induction, a parking routing means does not change a path but moves the image of the car after the induction termination on a perimeter environmental image according to the movement magnitude of a car with a display means.

(5) Invention of claim 5 displays the image of the car after the induction termination in consideration of a part of the door of a car closed [ opened and ] with a display means.

(6) Invention of claim 6 displays parking propriety decision Rhine for judging whether column parking space can be parked with a display means.

(7) An image pick-up means by which invention of claim 7 picturizes the perimeter environment of a car, A display means to display a perimeter environmental image, and a parking routing means to set up the path to a parking predetermined position and there based on a perimeter environmental image, By movement magnitude detection means to detect the movement magnitude of a car, the steering control means which controls steering of a car, the \*\*\*\*\* control means which controls a drive and braking of a car, and a steering control means and a \*\*\*\*\* control means It is applied to automatic parking equipment equipped with the parking control means which moves a car to a parking predetermined position in accordance with a parking path based on a movement magnitude detection value, and a display means indicates the image of the car after automatic parking termination by superposition in the parking predetermined position on a perimeter environmental image.

(8) Invention of claim 8 is equipped with a repositioning means to change a parking predetermined position, and moves the image of the car after automatic parking termination with a display means according to modification of the parking predetermined position by the repositioning means.

(9) Invention of claim 9 resets the path to the parking predetermined position after modification by the repositioning means with a parking routing means.

(10) When a car is moved by crew before the automatic parking equipment of claim 10 started automatic parking, a parking routing means does not change a path but moves the image of the car after the automatic parking termination on a perimeter environmental image according to the movement magnitude of a car with a display means.

(11) Invention of claim 11 displays the image of the car after the automatic parking termination in consideration of a part of the door of a car closed [ opened and ] with a display means.

(12) Invention of claim 12 displays parking propriety decision Rhine for judging whether column parking space can be parked with a display means.

[0006]

[Effect of the Invention] (1) According to invention of claim 1 and claim 7, the situation of the car after parking a car at it, before starting parking induction or automatic parking to the parking predetermined position on a perimeter environmental image since it was made to indicate the image of the car after induction termination or automatic parking termination by superposition can be checked.

(2) Since according to invention of claim 2 and claim 8 a repositioning means to change a parking predetermined position is established and the image of the car after induction termination or automatic parking termination was moved according to modification of the parking predetermined position by the repositioning means, a parking location can be changed upwards on a perimeter environmental screen, and the situation of the car after parking predetermined position modification can be checked.

(3) According to invention of claim 3 and claim 9, since the path to the parking predetermined position after modification was reset, a car can be certainly guided or moved to the parking predetermined position after modification.

(4) According to invention of claim 4 and claim 10, since the image of the car after the induction termination on a perimeter environmental image or automatic parking termination was moved according to the movement magnitude of a car, looking at the image of the car after parking by which it was indicated by superposition on the perimeter environmental image before induction initiation or automatic parking initiation, the car itself can be moved and a parking location can be changed. Moreover, the re-calculation of the path to the parking predetermined position accompanying modification of a parking location becomes unnecessary in this case.

(5) Since the image of the car after the induction termination in consideration of a part of the door of a car closed [ opened and ] or automatic parking was displayed according to invention of claim 5 and claim 11, even when parking a car at a narrow parking space, the parking location which crew tends to get on and off can be set up.

(6) Since parking propriety decision Rhine for judging whether the column parking space by parking induction or automatic parking can be parked was displayed according to invention of claim 6 and claim 12, even when a halt car exists in a perimeter, it can recognize whether a car can be parked.

[0007]

[Embodiment of the Invention] The gestalt of the 1 operation of a parking guide which directs operation to crew and guides a car to a parking location is explained.

[0008] Drawing 1 is drawing showing the configuration of the gestalt of 1 operation. This parking guide is equipped with cameras 1 and 2 the side and behind a car, respectively, and picturizes the perimeter environment of the side and back. In addition, as for cameras 1 and 2, each center line is perpendicularly installed to a car outside. A display 3 processes the perimeter environment picturized with cameras 1 and 2 by the graphic controller 4, and displays a perimeter environmental image. The steering angle sensor 5 detects the actuation angle of a steering. The actuation switches 6 are equipped with the initiation switch for directing initiation of parking induction, the adjustment tongue for changing a parking predetermined position, etc. A damping device 7 is equipment which makes a position suspend a car automatically. The right rear ring rotation sensor 8 and the left rear ring rotation sensor 9 output a pulse signal according to the rotation of a right rear ring and a left rear ring. By counting these pulse signals, the movement magnitude and the amount of revolution of a car are detectable. It performs halt control of a car with a damping device 7 while an arithmetic unit 10 consists of a microcomputer and its circumference component, sets up a parking location, calculates the path to a parking location based on the signal from cameras 1 and 2, the steering angle sensor 5, the actuation switches 6, and the wheel rotation sensors 8 and 9 and displays the situation of the car after parking a car at a display 3.

[0009] - Vehicle warehousing induction - The vehicle warehousing induction by the parking guide of the gestalt of 1

operation is explained first. This parking guide has memorized the default of a vehicle warehousing path as shown in the internal memory of an arithmetic unit 10 at drawing 2 . As mentioned above, the side camera 1 is installed so that the core Oc may become perpendicular to a car outside. This vehicle warehousing path is a path whose core Oc of the side camera 1 at the time of car induction initiation corresponds centering on the rear axle after induction termination. It moves forward once retreating and carrying out right full \*\*\*\* then from this induction starting position, at the time of vehicle warehousing, and it retreats, carrying out left full \*\*\*\* further, and goes into a parking frame (a slash hatch-way frame shows).

[0010] When turn combination when retreating the turn combination when moving forward the distance from the core Oc of the side camera 1 to the rear axle at the time of right full \*\*\*\* initiation clockwise by L and right full \*\*\*\* clockwise by alpha and left full \*\*\*\* is set to beta, it is [Equation 1] from drawing 2 .

【数 1】

$$L = \sqrt{(R_r + R_l)^2 - \left(R_r + \frac{W}{2}\right)^2} - R_l$$

[Equation 2]

【数 2】

$$\alpha = \cos^{-1} \frac{R_r + \frac{W}{2}}{R_r + R_l}$$

[Equation 3] It is given by  $\beta = \pi / 2 - \alpha$ . Here,  $R_r$  is [ the distance from the center of rotation of the car at the time of left full \*\*\*\* to a rear axle core and  $W$  of the distance from the center of rotation of the car at the time of right full \*\*\*\* to a rear axle core and  $R_l$  ] breadth of a car.

[0011] The pulse addition value of the rotation sensors 8 and 9 of the left rear ring from the location (induction starting position) stopped in front of the car barn to a right full \*\*\*\* location, or a right rear ring P1d, It is [Equation 4] when the pulse addition value of the right rear ring rotation sensor 8 until only turn combination beta carries out revolution retreat of the pulse addition value of the left rear ring rotation sensor 9 until only turn combination alpha carries out revolution advance from a right full \*\*\*\* location from P2d and a left full \*\*\*\* location is set to P3d.  $P1d = (L - lc) / \Delta$  -- [Equation 5]  $P2d = P1r - \alpha / 2\pi$  -- [Equation 6] It is set to  $P3d = P1r - \beta / 2\pi$ . The pulse addition value of the left rear ring rotation sensor 9 when  $\Delta$  rotates the migration length per one pulse of the rotation sensors 8 and 9 and  $lc$  and the distance from the core Oc of the side camera 1 to a rear axle and  $P1r$  rotate one time by right full \*\*\*\* here, and  $P1r$  are the pulse addition values of the right rear ring rotation sensor 8 when rotating one time by left full \*\*\*\*. If braking halt control of a car is performed so that the above pulse addition value P1d, P2d, and P3d may be filled, a car can be guided in accordance with the vehicle warehousing path mentioned above.

[0012] As shown in drawing 3 , when the screen system of coordinates of X-Y and a mounted camera are made into x-y for the road plane-coordinates system fixed to the car at the time of induction initiation here, it sets a focal distance to  $f$  for the height from the path road surface of the side camera 1, setting  $H_o$  and a pitch angle as  $\theta_o$ , and the relation between a point (X, Y) path on the street and the point on a screen (x y) is [Equation 7].  $x = -f \cdot X / (Y \cos \theta_o + H_o \sin \theta_o)$

( $Y \cos \theta_o + H_o \sin \theta_o$ )

[Equation 8]  $y = -f (Y \sin \theta_o - H_o \cos \theta_o) / (Y \cos \theta_o + H_o \sin \theta_o)$

It is come out and given.

[0013] Therefore, as shown in drawing 4 , the points A, B, C, and D of the car posterior part after induction are projected on the points CA ( $x_A, y_A$ ), CB ( $x_B, y_B$ ), CC ( $x_C, y_C$ ), and CD ( $x_D, y_D$ ) on a screen by a formula 7 and the formula 8. The example of a display which stained the closed region surrounded with CA, CB, CC, and CD these four points, and overwrote the perimeter environmental image of the side camera 1 is shown in drawing 5 . In drawing 5 , the hatch-way frame of a slash expresses a parking frame, and the stained closed region is the image of the car after the parking induction termination by which it is indicated by superposition in the parking predetermined position on a parking predetermined position projection image, i.e., the perimeter environmental image of a car.

[0014] Crew should just move a car until this parking predetermined position projection image comes to a location to park a car in a parking frame. For example, as shown in drawing 6 , the closed region stained on the screen of a display 3, i.e., a parking predetermined position projection image, moves a car to the location close to a left-hand side parking frame to park a car along with a left-hand side parking frame.

[0015] Or looking at a display screen, as shown in drawing 7 , without moving a car, a justification tongue (6) is operated and even a left-hand side parking frame carries out the parallel displacement of the parking predetermined position projection image. In this case, since a vehicle warehousing path changes according to moving a parking predetermined position projection image, a path is re-calculated.

[0016] Moreover, as shown in drawing 8 , also when the parking frame is slanting, looking at a display screen, a

parking predetermined position projection image can be rotated with a justification tongue (6), and as shown in drawing 9, a parking location can be set as the location of the arbitration of a parking within the limit. Since a vehicle warehousing path changes also in this case according to the rotation of a parking predetermined position projection image, a vehicle warehousing path is re-calculated.

[0017] Next, the moving method of a parking predetermined position projection image with a justification tongue (6) is explained. Drawing 10 shows an example of a justification tongue (6). This justification tongue 10 can perform migration and rotation of a parking predetermined position projection image on a display screen.

[0018] Drawing 11 expresses the condition that only (a and b) carried out the parallel displacement of the parking predetermined position projection image from the default condition. in this case -- a car -- a point -- A -- B -- C -- D -- respectively -- A -- '  $(-W/2+a, 0)$  -- B -- '  $(-W/2+a, L+b)$  -- C -- '  $(W/2+a, L+b)$  -- D -- '  $(W/2+a, 0)$  -- becoming -- a formula -- seven -- and -- a formula -- eight -- an image -- a top -- a point -- changing -- having .

[0019] Drawing 12 is from a default condition about a parking predetermined position projection image. - The condition that only theta rotated is shown. The points A, B, C, and D of a car, respectively In this case, A"  $(-W/2\cos\theta, 0)$ , B -- "  $(-W\cos\theta/2+L\sin\theta, W\sin\theta/2+L\cos\theta)$  -- C -- "  $(W\cos\theta/2+L\sin\theta, -W\sin\theta/2+L\cos\theta)$  -- D -- "  $(W/2\cos\theta, 0)$  -- becoming -- a formula -- seven -- and -- a formula -- eight -- an image -- a top -- a point -- changing -- having .

[0020] Drawing 13 - drawing 15 are flow charts which show vehicle warehousing induction of an arithmetic unit 10. These flow charts explain the vehicle warehousing induction procedure of the gestalt of 1 operation. In step 1, actuation of a vehicle warehousing switch (6) starts vehicle warehousing induction. As the perimeter environmental image picturized with the side camera 1 at step 2 is displayed on a display 3 and mentioned above at continuing step 3, a vehicle warehousing path is calculated. In step 4, as shown in drawing 5, the parking predetermined position projection image after the vehicle warehousing induction generated by the graphic controller 4 is overwritten and displayed on a display 3. When crew looks at this parking predetermined position projection image and changes a parking location, he moves or rotates a parking predetermined position projection image until it comes to the location in a parking frame to move a car or park a parking predetermined position projection image using a justification tongue (6) until a car comes to a location to park a car in a parking frame.

[0021] At step 5, actuation of the justification tongue (6) by crew is checked, when a parking location is changed with a justification tongue (6), it progresses to step 6, and a vehicle warehousing path is re-calculated according to the amount of adjustments. In addition, when it is not based on a justification tongue (6), but the car itself is moved and a parking location is changed, since a vehicle warehousing path does not change, the re-calculation of a path is unnecessary.

[0022] At step 7, if actuation of the initiation switch (6) by crew is checked and an initiation switch (6) is operated, it will progress to step 8 and brakes will be applied to a car with a damping device 7. And it displays on a display 3 at step 9, "Please put AT (automatic transmission) shift into reverse." If AT shift checks whether it is reverse at step 10 and it is set as reverse, it will progress to step 11 and will display on a display 3, "Please make a steering neutrality." At step 12, a steering checks whether it is neutrality by the steering angle sensor 5, and if it is neutrality, it will progress to step 13.

[0023] If a steering is taking a neutral attitude, the brake by the damping device 7 will be taken off at step 13. Thereby, a car retreats. If a car checks whether only predetermined distance has retreated in accordance with a vehicle warehousing path and only predetermined distance retreats at step 14, it will progress to step 15 and brakes will be applied to a car with a damping device 7. And it displays on a display 3 at step 16, "Please put AT shift into a drive." If it checks whether AT shift has been set as a drive at step 17 and set as a drive, it will progress to step 18 and will display on a display 3, "Please carry out right full \*\*\*\* of the steering."

[0024] If the steering angle of a steering is checked by the steering angle sensor 5 at step 19 and a steering is in a right full \*\*\*\* condition, it will progress to step 20, and the brake by the damping device 7 is taken off. Thereby, a car circles clockwise and moves forward at the diagonal right. Turn combination is checked by the left rear ring rotation sensor 9 at step 21, if only predetermined turn combination circles, it will progress to step 22, and brakes are applied to a car with a damping device 7.

[0025] In step 23, the perimeter environmental image picturized with the back camera 2 on the display 3 is displayed. Moreover, at step 24, it displays on a display 3, "Please put AT shift into reverse." If it checks whether AT shift has been set as reverse at step 25 and set as reverse, it will progress to step 26. At step 26, it displays on a display 3, "Please carry out left full \*\*\*\* of the steering."

[0026] If the steering angle of a steering is checked by the steering angle sensor 5 at step 27 and a steering is in a left full \*\*\*\* condition, it will progress to step 28, and the brake by the damping device 7 is taken off. Thereby, a car circles clockwise and retreats. Turn combination is checked by the right rear ring rotation sensor 8 at step 29, if only

predetermined turn combination circles, it will progress to step 30, and brakes are applied to a car with a damping device 7. And it displays on a display 3 at step 31, "Please make a steering neutrality." If the steering angle of a steering is checked by the steering angle sensor 5 at step 32 and a steering is in a neutral condition, it will progress to step 33. At step 33, it displays on a display 3, "While you correct a steering, please go into a car barn", and vehicle warehousing induction is ended.

[0027] - Explain induction - of column parking, next column parking by this parking guide. This parking guide has memorized the default of a column parking path as shown in the internal memory of an arithmetic unit 10 at drawing 16. In drawing 16, it is judged that column parking to the tooth space between the halt car 1 and the halt car 2 is possible, and suppose that the self-car left and stopped only distance  $L_0$  in parallel to the halt car 1. It goes straight on to 1st steering point A1B1C1D1, maintaining a steering at neutrality from the point (advance or retreat), it stops by 1st steering point A1B1C1D1, and full \*\*\*\* of the steering is carried out on the left. And it \*\*\*\* as it is, and clockwise, only the predetermined turn combination theta carries out revolution retreat, is stopped by 2nd steering point A2B2C2D2, and a steering is returned to neutrality. Next, a steering is \*\*\*\*(ed) to neutrality, only the predetermined distance  $n$  retreats, it stops by 3rd steering point A3B3C3D3, and full \*\*\*\* of the steering is carried out on the right. Furthermore, it \*\*\*\* with right full \*\*\*\*, and counterclockwise, only the predetermined turn combination theta carries out revolution retreat, and is stopped at column parking point A4B4C4D4.

[0028] Next, the conditions in which column parking is possible are considered. Drawing 17 shows the center line of rotation at the time of right full \*\*\*\* and left full \*\*\*\*, and the physical relationship of a car. Or shows the center line of rotation at the time of right full \*\*\*\*, and Ol shows the center line of rotation at the time of left full \*\*\*\*. The distance to Or empty vehicle both the forward left edge and R2 R1 The distance from Or to rear axle right-hand side, For the distance to Ol empty vehicle both the forward right edge, and R5, as for the distance to Ol empty vehicle both the right rear edge, and L1, the distance from Ol to rear axle left-hand side and R6 are [  $R_3$  / the distance to Or empty vehicle both the left rear edge, and  $R_4$  / the die length from the car front end to a rear axle and  $L_2$  ] overhangs.

[0029] About the distance between two cars FG of the halt car 1 and the halt car 2, when carrying out revolution retreat counterclockwise by right full \*\*\*\*, locus B3 ->B4 of the forward left edge of a self-car must not interfere with the right rear edge F of the front halt car 1, and back end section C4D4 must fulfill the front end section of the back halt car 2, and the conditions in which it does not interfere. The distance OF with the right rear edge F of the rear axle right-hand side O at the time of the completion of column parking to the front halt car 1 is [Equation 9].

【数 9】

$$OF \geq \sqrt{(R_1 + f_1)^2 - R_2^2}$$

Moreover, the distance OG with the forward right edge G of the rear axle right-hand side O at the time of the completion of column parking to the back halt car 2 is [Equation 10].  $OG \geq L_2 + f_2$  -- here,  $f_1$  and  $f_2$  are the allowances width of face set up beforehand. A formula 9 and a formula 10 are added and the distance between two cars FG of the halt car 1 and the halt car 2 is found.

[Equation 11]

【数 11】

$$FG \geq \sqrt{(R_1 + f_1)^2 - R_2^2} + L_2 + f_2$$

From a formula 11, the minimum distance between two cars b of the halt car 1 in which column parking is possible, and the halt car 2 is [Equation 12].

【数 12】

$$b = \sqrt{(R_1 + f_1)^2 - R_2^2} + L_2 + f_2$$

[0030] Depth  $e$  of a column parking space must fulfill the conditions to which locus C3 ->C4 of the Hidari back end section of a self-car does not interfere in the curbstone of the width of street, when carrying out revolution retreat counterclockwise by right full \*\*\*\*, if  $f_5$  is made into allowances width of face. Namely, [Equation 13] It is set to  $e \geq R_3 + f_5 - R_2$ .

[0031] Next, the retreat distance  $n$  from the turn combination theta from 1st steering point A1B1C1D1 to 2nd steering point A2B2C2D2 and 2nd steering point A2B2C2D2 to 3rd steering point A3B3C3D3 is found. When retreating straightly, making a steering neutrality, locus C2 ->C3 of the Hidari back end section of a car must fulfill the right rear edge F of the front halt car 1, and the conditions in which it does not interfere. That is, the die length of the segment which projected segment Or3F orthogonally in up to Or3Ol2 must be larger than  $(R_2 + W)$ . It is here and is [Equation 14]. It is [Equation 15] when the angle which Or3 F= $R_1 + f_1$  Or3F and Or3O makes is set to alpha.  $\cos \alpha = Or3 O / Or3F$ , i.e., [Equation 16]

【数 1 6】

$$\alpha = \cos^{-1} \frac{R_2}{R_1 + f_1}$$

It becomes. It is [Equation 17], when only  $f_3$  (allowances width of face set up beforehand) leaves the side of the right rear edge F of the halt car 1 and a self-car retreats. By  $Or3F\cos(\alpha-\theta)-(R_2+W)=f_3$  formula 14 and the formula 17, it is [Equation 18].  $\cos(\alpha-\theta)=(R_2+W+f_3)/(R_1+f_1)$

From a formula 18, it is [Equation 19].

【数 1 9】

$$\theta = \alpha - \cos^{-1} \frac{R_2 + W + f_3}{R_1 + f_1}$$

It is come out and given.

[0032] The distance  $n$  which retreats pays its attention to the die length of  $Ol3H$ , and is [Equation 20]. It is [Equation 21] when it asks about  $5n$  of  $R_5+W+Lo=(R_2+W+R_5)(1-\cos\theta)+n\sin\theta+R$ . It is set to  $\{W+Lo-(R_2+W+R_5)\}(1-\cos\theta)/\sin\theta$ .

[0033] Next, how to overwrite the parking predetermined position projection image after column parking induction at the perimeter environmental image of a parking lot is explained. As shown in drawing 18, the parking predetermined position of a self-car when induction is completed in accordance with the default of a column parking path is overwritten at the image of a side camera. The actual car location at this time is shown in drawing 19. The width of face of the car of a parking predetermined position projection image is larger than the width of face of a real car, and uses  $e$  of a formula 13. Crew can realize induction which does not interfere in a curbstone by moving the car itself to a location where this projection image does not interfere in a curbstone, or moving a parking predetermined position projection image on a display screen with a justification tongue (6). When a parking location is set up with a justification tongue (6), since the value of  $Lo$  of a default path changes, a path is re-calculated. Next, as shown in drawing 20, parking propriety decision Rhine is displayed on the location of the minimum distance between two cars  $b$  in which column parking is possible. Column parking is possible if the front halt car 1 has not interfered in this Rhine. [0034] Drawing 21 - drawing 24 are flow charts which show column parking induction of an arithmetic unit 10. These flow charts explain the column parking induction procedure of the gestalt of 1 operation. In step 41, actuation of a column parking switch (6) starts column parking induction. As mentioned above at step 43 which displays the perimeter environmental image picturized with the side camera 1 on a display 3, and follows it at step 42, a column parking path is calculated. In step 44, the parking predetermined position projection image after the column parking induction generated by the display 3 by the graphic controller 4 is overwritten and displayed. In crew looks at this parking predetermined position projection image and changing a parking location, it carries out migration and rotation of a parking predetermined position projection image on a display screen until it comes to the location in a parking frame to move the car itself or park a parking predetermined position projection image using a justification tongue (6) until a car comes to a location to park a car in a parking frame.

[0035] At step 45, actuation of the justification tongue (6) by crew is checked, when a parking location is changed with a justification tongue (6), it progresses to step 46, and a column parking path is re-calculated according to the amount of adjustments. In addition, it is not based on a justification tongue (6), and when the car itself is moved and a parking location is changed, since a column parking path does not change, a path is not re-calculated.

[0036] At step 47, if actuation of the induction initiation switch (6) by crew is checked and an induction initiation switch (6) is operated, it will progress to step 48 and will display on a display 3, "Please move forward slowly." By step 49, the perimeter environmental image picturized by the display 3 with the side camera 1 is displayed, and parking propriety decision Rhine is overwritten and displayed on the location equivalent to minimum die-length  $b$  of the tooth space which can be parked at continuing step 50. Here, as shown in drawing 20, when a front halt car is outside rather than parking propriety decision Rhine, crew judges that there is sufficient tooth space which can be column parked, and operates a column parking continuation switch (6). If a column parking continuation switch (6) is operated by crew at step 51, it will progress to step 52 and will display on a display 3, "Please stop."

[0037] If a halt of a car is checked in step 53 and a car stops, it will progress to step 54. At step 54, brakes are applied to a car with a damping device 7. It displays on a display 3 at step 55, "Please make a steering neutrality", and the steering angle of a steering is checked by the steering angle sensor 5 at continuing step 56. If the steering is in the neutral condition, the brake by step 57 HE progress and the damping device 7 will be taken off. Thereby, a car goes straight on to the 1st steering point. It checks whether at step 58, predetermined distance migration has been carried out in accordance with a column parking path by the rotation sensors 8 and 9 of a right-and-left rear wheel. If predetermined distance migration is carried out and the 1st steering point is arrived at, it will progress to step 59, and brakes are applied to a car with a damping device 7.



[0038] At step 60, it displays on a display 3, "Please put AT shift into reverse." If the location of AT shift is checked at step 61 and it is set as the reverse location, it will progress to step 62 and will display on a display 3, "Please carry out left full \*\*\*\* of the steering." The steering angle of a steering is checked by the steering angle sensor 5 at step 63, if a steering is in a left full \*\*\*\* condition, it will progress to step 64, and the perimeter environmental image picturized with the back camera 2 is displayed on a display 3. Next, the brake by the damping device 7 is taken off at step 65. Thereby, a car retreats in the state of left full \*\*\*\*.

[0039] At step 66, the right rear ring rotation sensor 8 detects turn combination, and it checks whether the predetermined turn combination theta searched for with the formula 19 has been reached. If the predetermined turn combination theta is reached, it will progress to step 67, and it stops, applying brakes to a car with a damping device 7. At step 68, it displays on a display 3, "Please make a steering neutrality." If the steering angle of a steering is checked by the steering angle sensor 5 at step 69 and a steering will be in a neutral condition, it will progress to step 70. The brake by the damping device 7 is taken off at step 70. Thereby, a car retreats straightly.

[0040] In step 71, the right-and-left rear wheel rotation sensors 8 and 9 detect the migration length of a car, and it checks whether only the predetermined distance n found with the formula 21 has retreated. If only the predetermined distance n retreats, it will progress to step 72, and it stops, applying brakes to a car with a damping device 7. At step 73, it displays on a display 3, "Please carry out right full \*\*\*\* of the steering." The steering angle sensor 5 detects the steering angle of a steering at step 74, and it checks whether right full \*\*\*\* of the steering is carried out. If right full \*\*\*\* is carried out, it will progress to step 75, and the brake by the damping device 7 is taken off. Thereby, a car retreats by right full \*\*\*\*.

[0041] It checks whether at step 76, the left rear ring rotation sensor 9 detected turn combination, and the predetermined turn combination theta has been reached. If the predetermined turn combination theta is reached, it will progress to step 77, and it stops, applying brakes to a car with a damping device 7. Next, it displays on a display 3 at step 78, "Please put AT shift into parking." If it checks whether AT shift is set as parking at continuing step 79 and is set as parking, it will progress to step 80 and will display on a display 3, "Please make a steering neutrality." The steering angle sensor 5 detects the steering angle of a steering at step 81, and it checks whether a steering is in a neutral condition. If a steering is in a neutral condition, it will progress to step 82, and the brake by the damping device 7 is taken off, and column parking induction is ended.

[0042] Thus, the situation of the car after parking a car at it, before starting parking induction to the parking predetermined position on a perimeter environmental image since it was made to indicate the image of the car after parking induction termination by superposition can be checked. Moreover, since the justification tongue (6) which changes a parking predetermined position is formed and the image of the car after parking induction termination was moved according to modification of a parking predetermined position with a justification tongue (6), a parking location can be changed upwards on a perimeter environmental screen, and the situation of the car after parking predetermined position modification can be checked. Furthermore, since the path to the parking predetermined position after modification was reset with modification of a parking predetermined position, a car can be certainly guided to the parking predetermined position after modification.

[0043] Moreover, since the image of the car after the parking induction termination on a perimeter environmental image was moved according to the movement magnitude of a car, before parking induction initiation, looking at the image of the car after parking by which it was indicated by superposition on the perimeter environmental image, the car itself can be moved and a parking location can be changed. Moreover, the re-calculation of the path to the parking predetermined position accompanying modification of a parking location becomes unnecessary in this case. Furthermore, since the image of the car after the parking induction termination in consideration of a part of the door of a car closed [ opened and ] was displayed, even when parking a car at a narrow parking space, the parking location which crew tends to get on and off can be set up.

[0044] the configuration of the gestalt of the above 1 operation -- setting -- the side camera 1 -- an image pick-up means -- a display 3 and a graphic controller 4 -- a display means -- the right rear wheel rotation sensor 8 and the left rear wheel rotation sensor 9 constitute a movement magnitude detection means, and the actuation switches 6 constitute [ an arithmetic unit 10 ] a repositioning means for a parking routing means, a guiding means, and a parking control means, respectively.

[0045] - Modification of the gestalt of 1 operation - Although the parking predetermined position projection image which indicates by superposition on a display screen at the time of vehicle warehousing was taking into consideration only the width of face of an actual car, you may make it express the parking predetermined position projection image in consideration of the tooth space of a door closed [ opened and ] as the gestalt of 1 operation mentioned above in consideration of closing motion of a door, or the ease of getting on and off, as shown in drawing 25 .

[0046] Moreover, as shown in drawing 26 , it may be made to indicate the drawing which looked at the car from the

front by superposition. With the method of presentation as shown in drawing 26 , when a car barn is slanting, drawing which looked at the car from before slant is overwritten and displayed.

[0047] Although the gestalt of 1 operation mentioned above showed the example to which brakes are automatically applied with a damping device, and crew carries out steering actuation and AT shift actuation, this invention is applicable also to \*\*\*\*\* of a car, and the automatic parking equipment which controls steering automatically altogether. Moreover, this invention is applicable also to the parking guide which does not perform any control of the actuator for \*\*\*\*\* and steering, but gives crew suitable operator guidance for parking.

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[Translation done.]

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## CLAIMS

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### [Claim(s)]

[Claim 1] An image pick-up means to picturize the perimeter environment of a car A display means to display said perimeter environmental image A parking routing means to set up the path to a parking predetermined position and there A movement magnitude detection means to detect the movement magnitude of a car The guiding means which guides a car to said parking predetermined position in accordance with said path based on said movement magnitude detection value It is the parking guide equipped with the above, and said display means is characterized by indicating the image of the car after induction termination by superposition in said parking predetermined position on said perimeter environmental image.

[Claim 2] It is the parking guide which is equipped with a repositioning means to change said parking predetermined position, in a parking guide according to claim 1, and is characterized by said display means moving the image of the car after induction termination according to modification of the parking predetermined position by said repositioning means.

[Claim 3] It is the parking guide characterized by said parking routing means resetting the path to the parking predetermined position after modification by said repositioning means in a parking guide according to claim 2.

[Claim 4] It is the parking guide which said parking routing means does not change said path, but is characterized by said display means moving the image of the car after the induction termination on said perimeter environmental image according to the movement magnitude of a car when a car is moved by crew in a parking guide according to claim 1 before starting parking induction.

[Claim 5] It is the parking guide characterized by displaying the image of the car after the induction termination as which said display means considered a part of the door of a car closed [ opened and ] in the parking guide given in one term of claims 1-4.

[Claim 6] It is the parking guide characterized by displaying parking propriety decision Rhine for judging whether said display means can park column parking space in a parking guide given in one term of claims 1-4.

[Claim 7] An image pick-up means to picturize the perimeter environment of a car A display means to display said perimeter environmental image A parking routing means to set up the path to a parking predetermined position and there based on said perimeter environmental image A movement magnitude detection means to detect the movement magnitude of a car The parking control means which moves a car to said parking predetermined position in accordance with said parking path based on said movement magnitude detection value by the steering control means which controls steering of a car, the \*\*\*\*\* control means which controls a drive and braking of a car, and said steering control means and the aforementioned system drive control means It is automatic parking equipment equipped with the above, and said display means is characterized by indicating the image of the car after automatic parking termination by superposition in said parking predetermined position on said perimeter environmental image.

[Claim 8] It is the parking guide which is equipped with a repositioning means to change said parking predetermined position, in automatic parking equipment according to claim 7, and is characterized by said display means moving the image of the car after automatic parking termination according to modification of the parking predetermined position by said repositioning means.

[Claim 9] It is automatic parking equipment characterized by said parking routing means resetting the path to the parking predetermined position after modification by said repositioning means in automatic parking equipment according to claim 8.

[Claim 10] It is automatic parking equipment which said parking routing means does not change said path, but is characterized by said display means moving the image of the car after the automatic parking termination on a perimeter environmental image according to the movement magnitude of a car when a car is moved by crew in automatic parking equipment according to claim 7 before starting automatic parking.

[Claim 11] It is automatic parking equipment characterized by displaying the image of the car after the automatic parking termination as which said display means considered a part of the door of a car closed [ opened and ] in automatic parking equipment given in one term of claims 7-10.

[Claim 12] It is automatic parking equipment characterized by displaying parking propriety decision Rhine for judging whether said display means can park column parking space in automatic parking equipment given in one term of claims 7-10.

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[Translation done.]

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DESCRIPTION OF DRAWINGS

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## [Brief Description of the Drawings]

[Drawing 1] It is drawing showing the configuration of the gestalt of 1 operation.

[Drawing 2] It is drawing explaining a vehicle warehousing path.

[Drawing 3] It is drawing explaining the relation between a road plane-coordinates system and the screen system of coordinates of a mounted camera.

[Drawing 4] It is drawing showing the physical relationship of the car parking induction initiation before on a display screen, and after parking induction termination.

[Drawing 5] It is drawing showing the example of a display which indicated the parking predetermined position projection image of a car by superposition on the perimeter environmental image of a car.

[Drawing 6] Before starting parking induction, it is drawing showing the example of a display of the parking predetermined position projection image of a car at the time of moving the car itself and changing a parking location.

[Drawing 7] Before starting parking induction, it is drawing showing the example of a display of the parking predetermined position projection image of a car at the time of changing a parking location with a parking justification tongue.

[Drawing 8] It is drawing showing a parking path when the parking frame is slanting.

[Drawing 9] It is drawing showing the example of a display in the case of rotating a parking predetermined position projection image with a parking justification tongue to a slanting parking frame, and setting up a parking location.

[Drawing 10] It is drawing showing an example of a parking justification tongue.

[Drawing 11] It is drawing showing the physical relationship of the car after induction termination parking induction initiation before at the time of carrying out the parallel displacement of the parking location with a parking justification tongue.

[Drawing 12] It is drawing showing the physical relationship of the car after induction termination parking induction initiation before at the time of rotating the car after parking with a parking justification tongue.

[Drawing 13] It is the flow chart which shows vehicle warehousing actuation of the gestalt of 1 operation.

[Drawing 14] It is the flow chart following drawing 13 which shows vehicle warehousing actuation of the gestalt of 1 operation.

[Drawing 15] It is the flow chart following drawing 14 which shows vehicle warehousing actuation of the gestalt of 1 operation.

[Drawing 16] It is drawing showing a column parking path.

[Drawing 17] It is drawing showing the physical relationship of the center of rotation at the time of right-and-left full \*\*\*\*, and a car.

[Drawing 18] It is drawing showing the example of a display which indicated the parking predetermined position projection image of a car by superposition on the perimeter environmental image of a car.

[Drawing 19] It is drawing which looked at the parking predetermined position of the car shown in drawing 18 from right above.

[Drawing 20] It is drawing showing the example which indicated the minimum distance between two cars in which column parking is possible, and parking propriety decision Rhine by superposition at the perimeter environmental image of a car.

[Drawing 21] It is the flow chart which shows actuation of column parking of the gestalt of 1 operation.

[Drawing 22] It is the flow chart following drawing 21 which shows actuation of column parking of the gestalt of 1 operation.

[Drawing 23] It is the flow chart following drawing 22 which shows actuation of column parking of the gestalt of 1 operation.

[Drawing 24] It is the flow chart following drawing 23 which shows actuation of column parking of the gestalt of 1 operation.

[Drawing 25] It is drawing showing the example which displayed the parking predetermined position projection image in consideration of a part of the door of a car closed [ opened and ].

[Drawing 26] It is drawing showing the example which indicated the line in consideration of a part of the door of a car closed [ opened and ] by superposition at the parking predetermined position projection image.

[Description of Notations]

1 Side Camera

2 Back Camera

3 Display

4 Graphic Controller

5 Steering Angle Sensor

6 Actuation Switches

7 Damping Device

8 Right Rear Ring Rotation Sensor

9 Left Rear Ring Rotation Sensor

10 Arithmetic Unit

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[Translation done.]

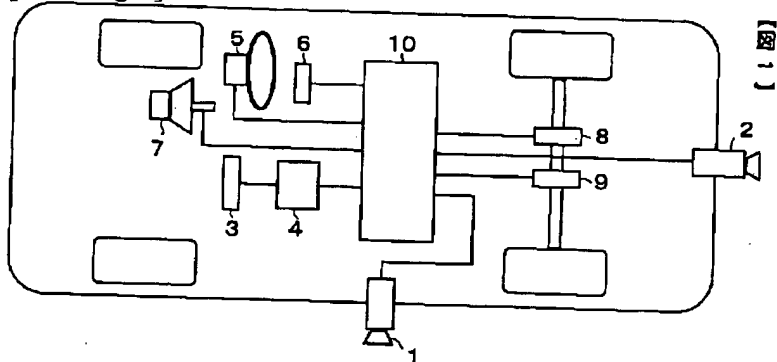
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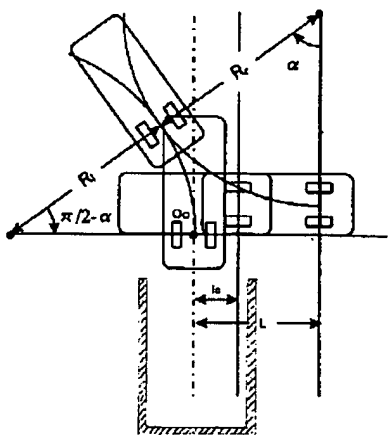
## DRAWINGS

[Drawing 1]



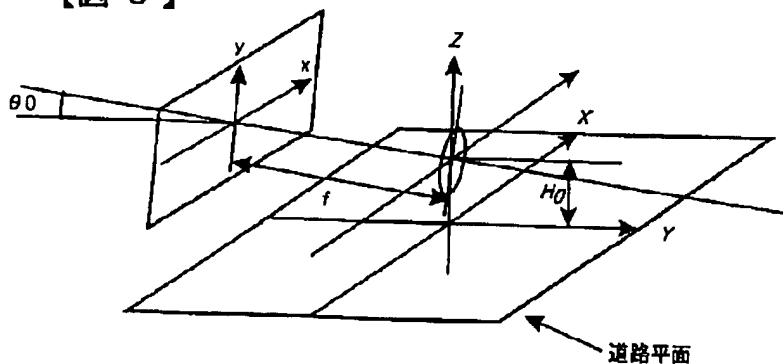
[Drawing 2]

【図 2】



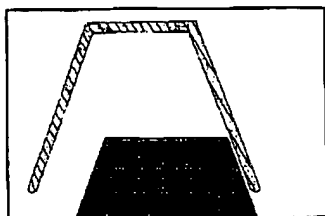
[Drawing 3]

【図 3】



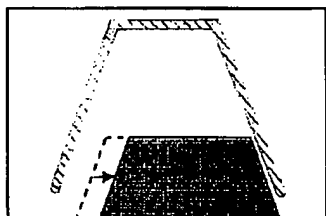
[Drawing 6]

【図 6】



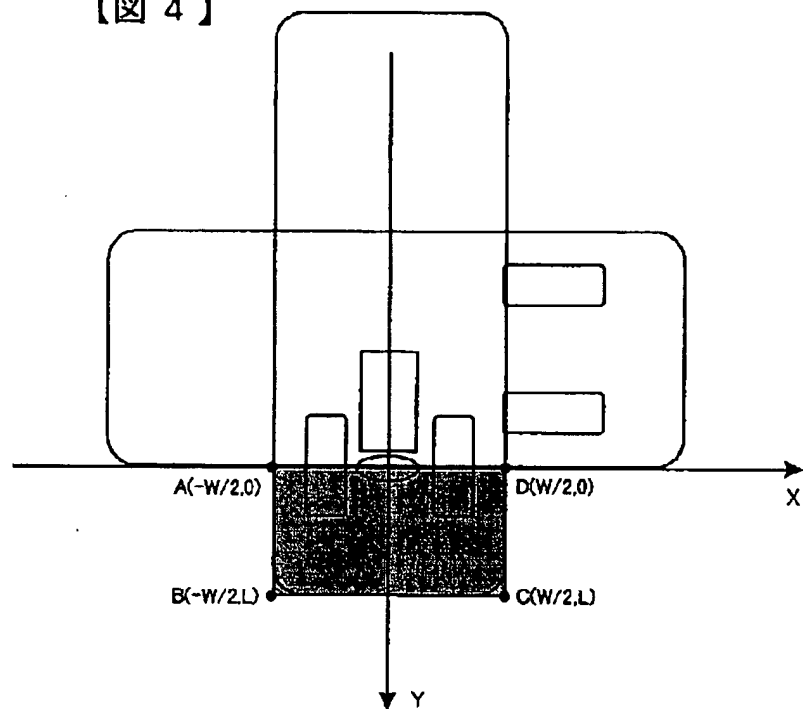
[Drawing 7]

【図 7】



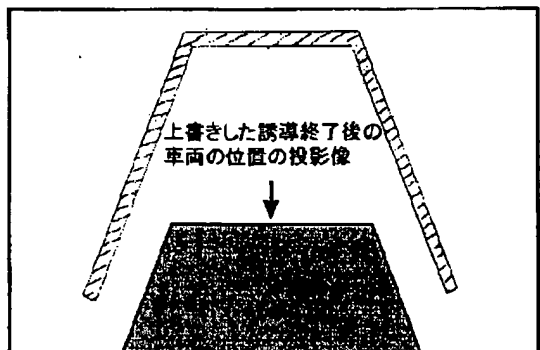
[Drawing 4]

【図 4】



[Drawing 5]

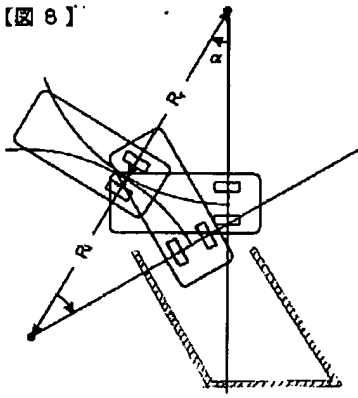
【図 5】



[Drawing 8]

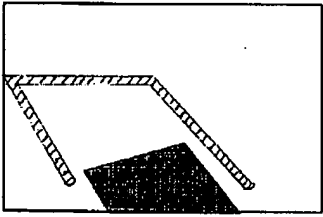


【图 8】



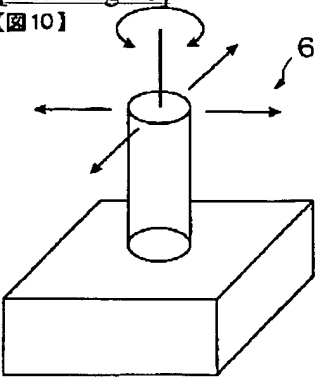
[Drawing 9]

【图 9】



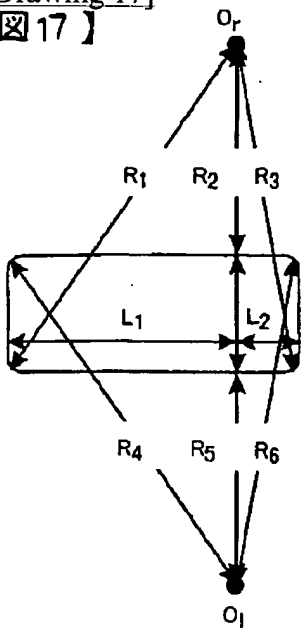
[Drawing 10]

【图 10】



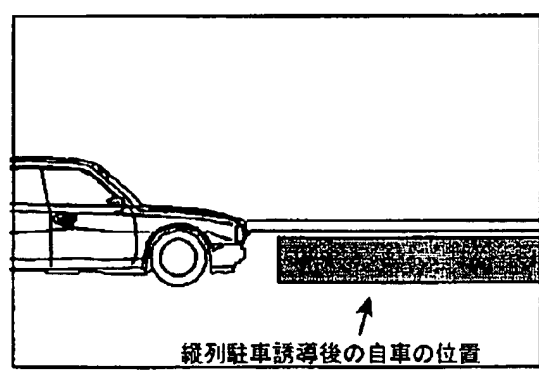
[Drawing 17]

【图 17】

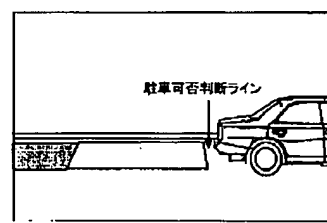


[Drawing 18]

【図 18】

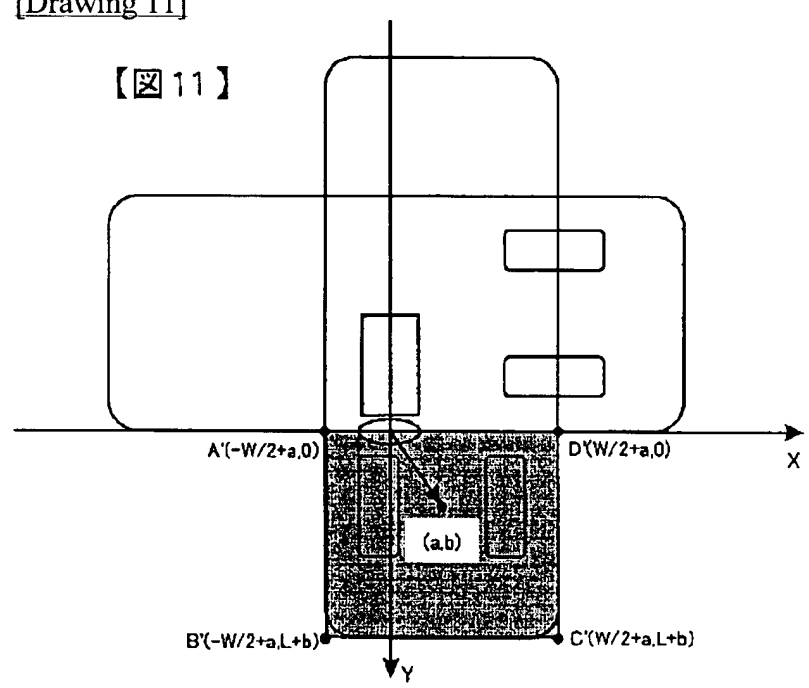


[Drawing 20]  
【図 20】



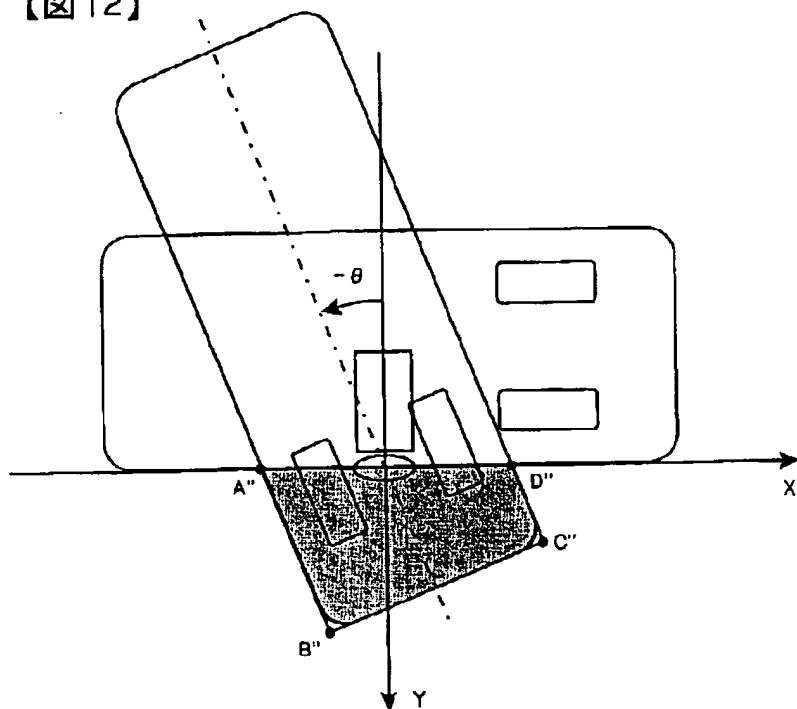
[Drawing 11]

【図 11】



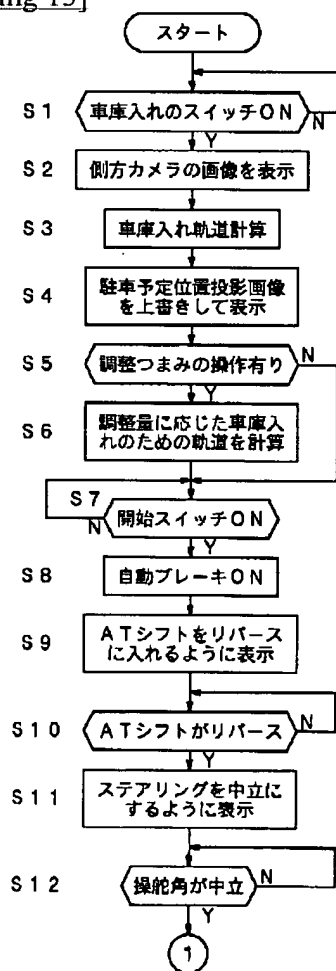
[Drawing 12]

【図12】



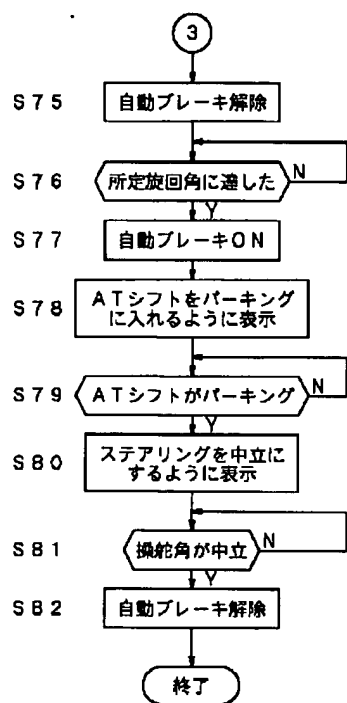
[Drawing 13]

【図13】



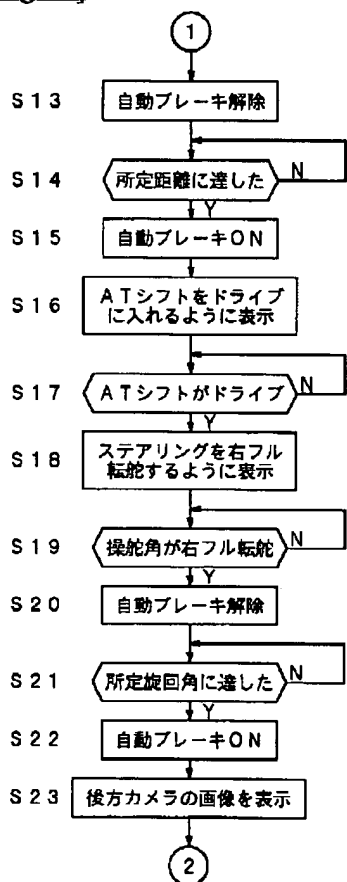
[Drawing 24]

【図 24】



[Drawing 14]

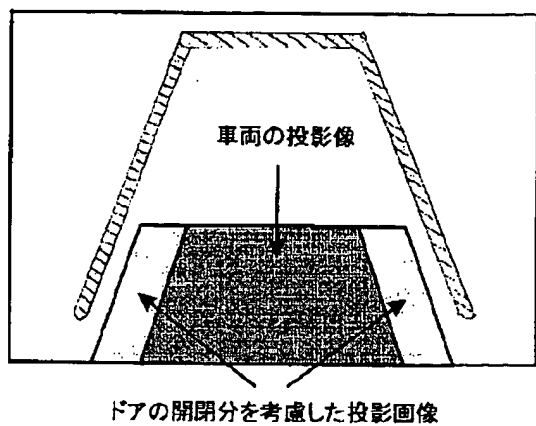
【図 14】



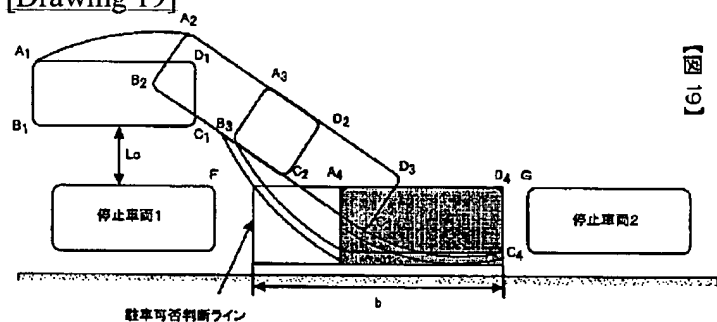
[Drawing 15]



【図25】



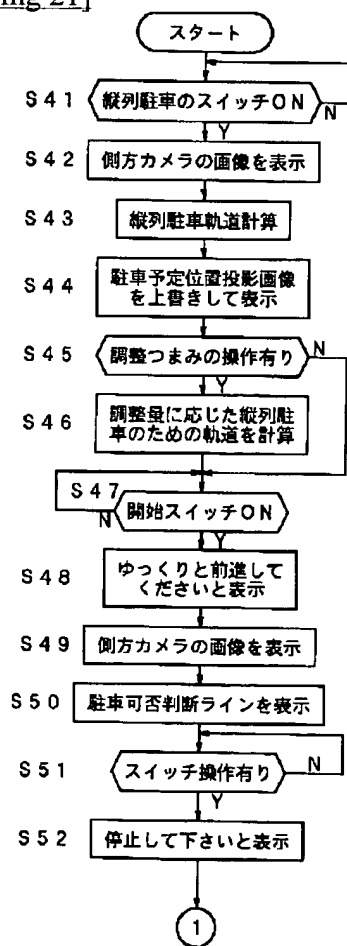
[Drawing 19]



【図19】

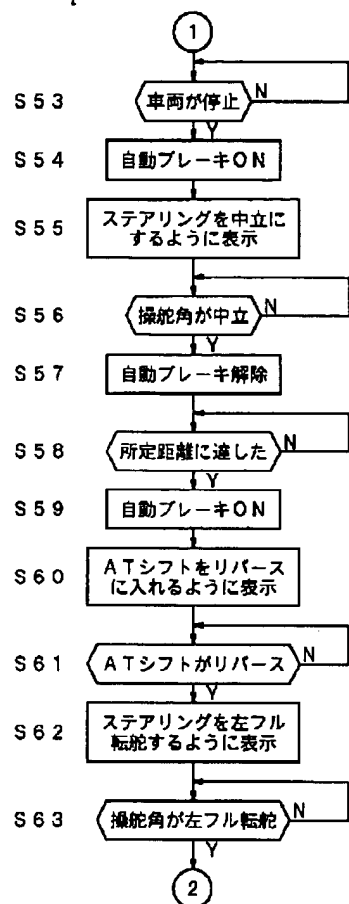
[Drawing 21]

【図21】



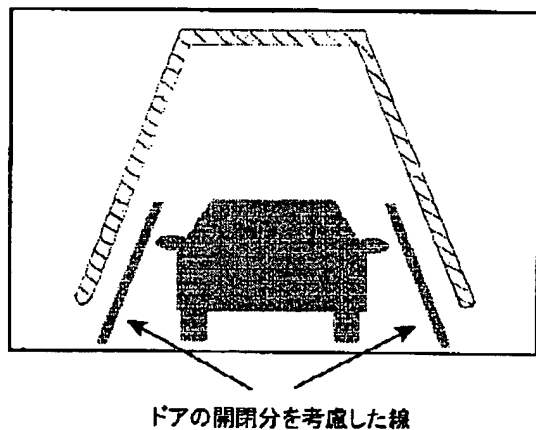
[Drawing 22]

【図22】



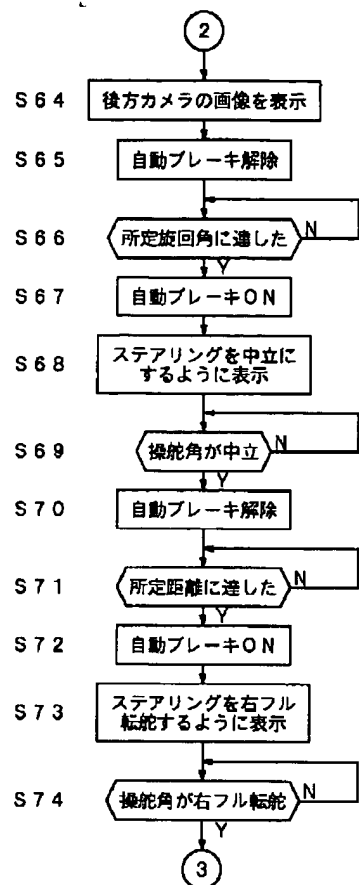
[Drawing 26]

【図26】



[Drawing 23]

【図23】



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[Translation done.]